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A REVISION OF THE GENUS DENDROCORIS AND ITS GENERIC RELATIONSHIPS

(HEMIPTERA, PENTATOMIDAE)[1,2]

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The generic name *Dendrocoris* was proposed by Bergroth in 1891 for *Liotropis* Uhler, 1877, which was found to be preoccupied by *Liotropis* Fitzinger, 1843, in the Reptilia. The type of the genus *Dendrocoris* is *humeralis* (Uhler), 1877, the only originally included species in the genus *Liotropis*. The latest work on the genus is the key to the species by Torre-Bueno (1939).

The position of *Dendrocoris* within the family Pentatomidae has been a matter of dispute. It was first regarded by Uhler (1886) as belonging to subfamily Asopinae. It was later placed in the subfamily Pentatominae near the Brazilian genus *Lopadusa* Stål by Bergroth (1891). Montandon (1893) concurred with this placement and Kirkaldy (1909), in his systematic arrangement, placed *Dendrocoris* between *Lopadusa* Stål and *Bothrocoris* Mayr. A critical study of *Dendrocoris* and closely related genera has indicated that this systematic arrangement should be modified. *Lopadusa* differs from *Dendrocoris* in its extremely small and proportionately shorter head, much elevated bucculae which are shorter than the first rostral segment, as well as the form of the mesosternum which has a pronounced median keel and metasternum which is broadly elevated. In *Dendrocoris* the head is slightly broader than long, but not to the extent found in *Lopadusa*, and the first rostral segment is shorter than the bucculae. The mesosternum and metasternum, instead of being keeled or elevated, are depressed to the extent of having a shallow median groove. The genus *Bothrocoris* also has the raised meso- and metasternum and is closely allied with *Lopadusa*. These two genera apparently belong to a group within the tribe Pentatomini quite apart from that to which *Dendrocoris* belongs.

The group to which *Dendrocoris* belongs appears to include the genera *Odmalea* Bergroth and *Brepholoxa* Van Duzee.

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[1] Part of a thesis submitted to the Faculty of the Graduate School of the University of Maryland in partial fulfillment of the requirements for the degree of Master of Science.

[2] Scientific Article No. A493. Contribution No. 2599 of the University of Maryland Agricultural Experiment Station (Department of Entomology).

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Bergroth (1914) established the genus *Odmalea* for two species, *quadripunctula*, which he designated as the type of the genus, and *schaefferi* Barber, transferred from *Dendrocoris*. Kirkaldy (1909) placed the genus *Brepholoxa* near *Arvelius* Spinola to which it bears but a superficial resemblance. The following characteristics clearly ally *Brepholoxa* to *Dendrocoris* and *Odmalea:* (1) depressed mid-ventral line of meso- and metasternum (2) bucculae longer than the first rostral segment and (3) the projection anteriorly of the second ventral abdominal segment into a rather prominent blunt spine. The three genera may be separated by the following key:

1. Second segment of antennae always longer than the third, fourth, or fifth segments; ostiolar canal reduced to a short raised and blunt projection, never reaching the lateral ⅓ of evaporative area .... *Brepholoxa* Van Duzee

Second segment of antennae always shoretr than the third, fourth or fifth joints; ostiolar canal long and tapering, attaining the lateral ⅓ of evaporative area 2

2. Femora with the apex above produced into a short spine or angle; humerus of pronotum produced into an acute triangular process .... *Odmalea* Bergroth

Femora unarmed apically; humerus of pronotum, if produced, an obtusely rounded process .... *Dendrocoris* Bergroth

The genus *Atizies* described by Distant (1893) is a synonym of *Dendrocoris*. Distant's description and figure of *Atizies suffultus* seem to differ from *Dendrocoris* only by his statement that the tibiae are sulcate. Actually the sulcation is obscure on the anterior and middle tibia and distinct only on the posterior tibia. Dr. W. E. China has examined the type of *suffultus* and confirmed its identity as a true *Dendrocoris*.

The genus *Dendrocoris* and the two closely related genera mentioned above are confined to the Western Hemisphere. *Brepholoxa* is known from Florida, and *Odmalea* from Texas, Panama, Bolivia, Brazil and Uruguay. *Dendrocoris* is known from northern United States, from the East to the West Coast, south to Southern Mexico, with the center of distribution apparently in the Lower Sonoran Life Zone of the Southwestern U. S. and Mexico.

The biology of *Dendrocoris* is poorly known. From available information it is found on various trees and shrubs, except two Mexican species which came from orchids. More specific information, when known, is given in the discussion of each species.

The technique used to study the internal male genitalia of *Dendrocoris* is as outlined by Sailer (1952), with the exception of the method of relaxing the specimens. Instead of using the 95% alcohol, etc., solution, the specimens were relaxed by immersing them for 30 seconds in boiling water.

The terminology of the parts of the internal male genitalia used in this paper is based on that proposed by Baker (1931). All descriptions are with penis lobes of aedeagi distended; length measurements are made from the tip of the head to the apex of the membrane and widths are measured across the body at the base of the hemelytra.

Acknowledgments.—The writer wishes to express his sincere appreciation to Dr. R. I. Sailer of the U. S. National Museum, at whose suggestion and under whose direction this study was undertaken, for the benefit of his experience in taxonomy and his knowledge of the literature. Thanks are also due to Dr. William E. Bickley of the University of Maryland for his encouragement and suggestions; to Dr. W. E. China of the British Museum for comparing specimens with the type of *Atizies suffultus* Distant; and to the following institutions and individuals for the loan of material in their collections: United States National Museum (through R. I. Sailer); University of Kansas Snow Entomological Museum (through R. H. Beamer); University of California (through John D. Lattin); Chicago Natural History Museum (through R. L. Wenzel); Museum of Comparative Zoology (through P. J. Darlington); The American Museum of Natural History (through Herbert Ruckes); California Academy of Sciences (through E. S. Ross); Ohio State University (through J. N. Knull); University of Michigan (through T. H. Hubbell).

Dendrocoris Bergroth

Liothropis Uhler, 1877, Bul. U. S. Geol. Survey, 3:399; 1886, Checkl. Hem.-Het. N.A.; 5; Lethierry and Severin, 1893, Cat. General Hemip., Tome I: 186; Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Dendrocoris Bergroth, 1891, Revue d'Ent. 10:228; 1908, Mem. Soc. Ent. Belgique 15:177; 1914, Ann. Soc. Ent. Fr. 83:438,439; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:262; 1911, Ent. News 22:268; Kirkaldy, 1909, Cat. Hemip. 1:151; 1912, Proc. Ent. Soc. Hawaii 2:126; Banks, 1910, Cat. Nearct. Hem.-Het. p. 84; Van Duzee, 1917, Cat. Hemip. N. Amer.:64; Stoner, 1920, Iowa Univ. Studies in Nat. Hist. 8:112, 113; Parshley, 1923, Hemip. Conn. 769; Blatchley, 1926, Heterop. East. N. Amer.: 173; Torre-Bueno, 1939, Ent. Americana 19:208, 240; Froeschner, 1941, Amer. Midland Nat. 26:128.

Atizies Distant, 1893, Biol. Cent. Amer., Heterop., I:456. (New synonomy.)

GENERIC DESCRIPTION

Color.—The general coloration is variable. Dorsum punctured fairly uniformly with concolorous punctures or in part or wholly fuscous to black. Punctures of venter pale concolorous. Pronotal cicatrices with a transversely elongate ring of punctures. Legs and antennae pale testaceous sometimes tinged with or completely rufous. Rostrum straw color to rufous with a median line and distal portion of terminal segment black.

Structure.—Oval to broad oval, sides subparallel, tapering rather sharply anteriorly, more gradually posteriorly. Moderately convex dorsally and strongly so ventrally. Anterior half of pronotum and head slightly to rather strongly declivous. Head broader across eyes than long, juga contiguous before tylus. Tubercle of antennifer in part or almost wholly distinct from above. First segment of antennae short and stout, second to fifth slender with second equal to or greater in length than first and third, fourth and fifth longer than either joints 1 or 2. Second joint of antennae longer in female than in males (except *reticulatus*, in which they are subequal). Third joint longer in males than in females in all cases. Rostrum slender and extending to but not beyond posterior coxae. First and fourth rostral segments short, subequal in length, the second being the longest segment and third somewhat shorter but longer than segments one or four. Pronotum usually obtusely prominent, with a small tooth at anterior lateral angles. Ostiolar canal extending antero-lateraly to outer third of episternum, evaporative area well defined. Thoracic sterna depressed as a shallow groove. Tibiae sulcate, except in *variegatus*, the males of which have sulcate anterior and middle tibiae but terete posterior tibiae, while the females have sulcate posterior tibiae, flattened middle tibiae and terete anterior tibiae. Scutellum as broad at base as long, apex rounded. Outer angles of corium bluntly acute. Connexivum exposed. Second ventral abdominal segment produced anteriorly at middle as a blunt spine, except in males of *humeralis* and *variegatus* which have but a median convexity.

Male genitalia.—Genital segment (ninth abdominal) a deep cup opening dorsoposteriorly. Anterior margin rounded downward; posterior margin of lip on either side of median notch, variously produced as a plate-like process. The inner margins of the processes carinate, the carinae extending downward on ventral surface of hypopygium approximately one fourth to one third the total exposed length. Hypopygium, from a ventral view, strongly convex at base and concave postero-laterally on either side of mesal carinae. Clasper with ental arm elongate and narrowly rounded; ectal arm variously produced or not at all, never equaling the ental arm.

Aedeagus with lateral penis lobes well developed, projecting laterally with distal portion variously turned; median penis lobe distinct but not as prominent as lateral lobes; penisfilum curving upward, apex pointed dorsally or postero-dorsally.

Female external genitalia.—Genital plates varying in size and placement. Subgenital plates bluntly acuminate at tip, not reaching posterior margin of middorsal plate. Lateral plates with apices not extending beyond posterior margin. Middorsal plate contiguous with lateral plates, their margins together evenly rounded in outline or slightly sinuate. Female internal genitalia not examined.

KEY TO THE SPECIES OF DENDROCORIS

1. Vertex of head and base of tylus distinctly convex 2
Vertex of head and base of tylus in part flat 4
2. Antero-lateral margins of pronotum straight or somewhat convexly arcuated (W. and S.W. United States) .... *pini* Montandon
Antero-lateral margins of pronotum concavely arcuated 3
3. General body color rufous, or if clay yellow, connexivum with black band at base and apex of each segment. (New Mexico) .... *neomexicanus*, new species (p. 64)
General body color flavotestaceous; connexivum without a black band at base and apex of each segment (S. W. United States) .... *contaminatus* Uhler
4. Antero-lateral margins of pronotum straight or substraight 5
Antero-lateral margins of pronotum concavely arcuated 7
5. Veins of membrane reticulated; form broad oval (Arizona) ....

.... *reticulatus* Barber

Veins of membrane not reticulated; form more narrow, suboval 6

6. Connexivum with a distinct black spot at incisures which is separated from lateral margin; spiracles raised, black (S. E. United States) .... *fruticicola* Bergroth

Connexivum with a fuscous or black band on either side of incisures, if black always extending to lateral margins; spiracles generally pale concolorous (S. W. United States) .... *arizonensis* Barber

7. Spiracles black; second ventral abdominal segment produced anteriorly at middle as a short blunt spine in both sexes (Mexico) .... *suffultus* (Distant)

Spiracles pale; second ventral abdominal segment produced anteriorly at middle in female only 8

8. Head distinctly wider than long, a ratio of 1.36 to 1; male hypopygium with a distinct tooth at antero-ventral apex of each median carina; anterior margin of male head with widely spaced denticles (Mexico) .... *variegatus*, new species (p. 60)

Head appears to be as long as wide, actually width to length a ratio of 1.26 to 1; male hypopygium without a tooth at antero-ventral apex of each median carina; head of male smoothly rounded in front (United States) .... *humeralis* (Uhler)

Dendrocoris humeralis (Uhler)

Liotropis humeralis Uhler, 1877, Bul. U. S. Geol. Survey 3:400; 1886, Checkl. Hem.-Het. N.A.: 5; Lethierry and Severin, 1893, Cat. Gen. Hemip., Tome I.: 186; Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Dendrocoris humeralis (Uhler): Bergroth, 1891, Revue d'Ent. 10:228, 229; 1914, Ann. Soc. Ent. Fr. 83:438, 439; Uhler, 1904, Proc. U. S. Natl. Mus. 27:351: Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:262; 1911, Ent. News 22:269; Kirkaldy, 1909, Cat. Hemip. 1:151; 1912, Proc. Ent. Soc. Hawaii 2:126; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Van Duzee, 1917, Cat. Hemip. N. Amer.: 64; Stoner, 1920, Iowa Univ. Studies in Nat. Hist. 8:113; Parshley, 1923, Hemip. Conn.: 769; Blatchley, 1926, Heterop. East. N. Amer.: 173; Torre-Bueno, 1939, Ent. Americana 19:241; Froeschner, 1941, Amer. Midland Nat. 26:131.

Color.—Pale testaceous or clay yellow above and below frequently tinged with orange or rufous. Dorsal punctures variable. Head clay yellow narrowly margined with black and coarsely and thickly punctured with black or brown, except for impunctate anterior and antero-lateral jugal margins, and two impunctate spots located on either side anterior to the ocelli and mesal to compound eyes, lateral spot oval and well defined, median spot elongate and less well defined. Eyes red to dark brown, ocelli red. Head beneath coarsely and thickly punctured with concolorous or pale ochraceous punctures, more numerous between bucculae and eyes. Dark line running from eye over base of tubercle of antennifer anteriorly. Antennae rufous, basal joint paler. Rostrum pale yellow or tinged with rufous, with a median line and distal half of terminal segment piceous or black. Pronotum pale testaceous or clay yellow sometimes with orange or rufous lateral margins. Punctures of pronotum concentrated at margins and frequently producing dark areas anteriorly and four spots (not always evident) across the disk, two near midline and two near lateral margins. Propleura thickly punctured with concolorous or pale ochraceous coarse punctures as on head, becoming coarser and darker (sometimes black) laterally, less numerous on mesopleura and much smaller and less numerous on the metapleura. Scutellum testaceous or clay yellow, thickly punctured rufous to black with concentrations at base forming irregular spots. Punctures less concentrated on disk, a black spot on either side at distal extent of frenum. Hemelytra testaceous or clay yellow with rose tints often coloring base or disk, punctures frequent but irregular, leaving a few bald spots on disk and costal margins. Membrane pale ochraceous, connexivum testaceous with orange tint, posterior lateral angles of segments black, sometimes anterior and posterior margins also. Abdominal venter testaceous or pale yellow with flecks of rufous, punctures concolorous or ochraceous to black laterally, fine and sparse on disk becoming coarse and concentrated laterally. Black spot evident at posterior lateral angles of segments. Spiracles concolorous with venter. Posterior edge of female anal segment black on each side.

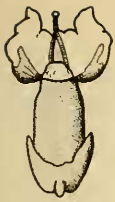
Structure.—Form broad-oval, with prominent humeri. Head width to length a ratio of 1.26 to 1, broadly rounded in front; sides subparallel; vertex flat. Tylus much shorter than juga. Almost all of tubercle of antennifer visible from above. Lateral margins of pronotum before humeri concave. Length: ♂, 6.3-7.3 mm; ♀, 7.0-8.5 mm. Width: ♂, 3.7-4.45 mm.; ♀, 4.2-4.9 mm.

Male genitalia.—As in figures 1-4. Hypopygium as viewed from beneath concave posteriorly on either side of middle, with a well defined notch in median posterior margin. Hypopygium on either side of median notch produced posteriorly as a plate and reflexed upward and forward with a slight torsion toward the outside; mesal and lateral angles of plate acutely produced. Clasper rounded medially, concave laterally, with ental arm elongate and narrowly rounded at apex, ectal arm reduced to a rounded lobe. Proctiger slightly concave ventrally and convex dorsally, posterior ventral margin truncate.

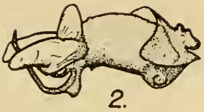
Female genitalia.—As shown in figure 14, strongly pitted with large punctures. Genital plates small and separated by twice their width at base. Subgenital plates bluntly acuminate at tip. Lateral plates contiguous with middorsal plate, their margins together rounded posteriorly.

Variation.—Color varies considerably as mentioned above, a few specimens with punctures uniformly light colored, others with punctures almost wholly black.

Male hypopygia are shown from a ventral caudal view; female genitalia from a ventral view. Punctation not indicated. *Dendrocoris humeralis* (Uhler): fig. 1, aedeagus, dorsal view; fig. 2, same, dextral view; fig. 3, clasper, postero-ventral view; fig. 4, male genital segment, showing ventral median notch posteriorly on hypopygium, hypopygial plates and mesal carinae; fig. 14, female genital segment, ventral view; fig. 5, *D. contaminatus* Uhler, male genital segment; fig. 6, *D. fruticicola* Bergroth, male genital segment; fig. 7, *D. arizonensis Barber,* male genital segment; fig. 15, female genital segment; fig. 8, *D. suffultus* (Distant), male genital segment; fig. 9, *D. variegatus,* new species, male genital segment; fig. 10, *D. reticulatus* Barber, male genital segment; fig. 12, female genital segment; fig. 11, *D. pini* Montandon, male genital segment; fig. 13, *D. neomexicanus,* male genital segment.



1.



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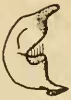

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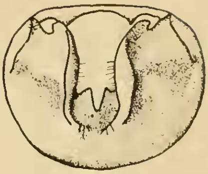
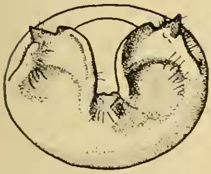
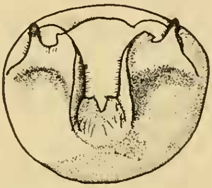


4.

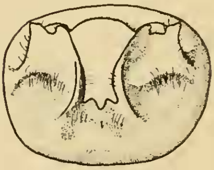
Dendrocoris humeralis



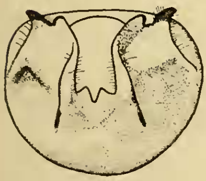
5. contaminatus



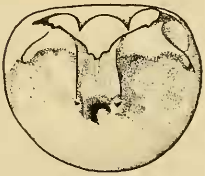
6. fruticicola



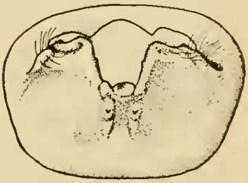
7. arizonensis



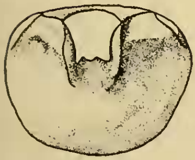
8. suffultus



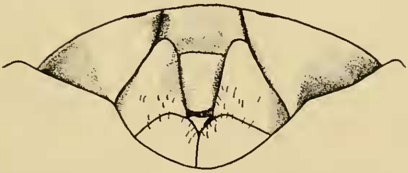
9. variegatus



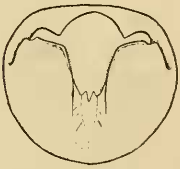
10. reticulatus



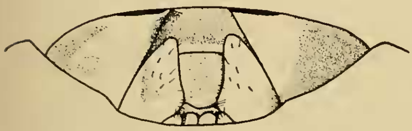
11. pini



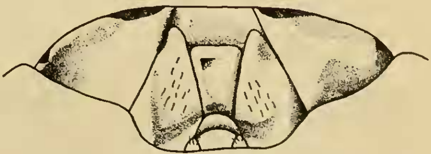
12. reticulatus



13. neomexicanus



14. humeralis



15. arizonensis

Spiracles in a few specimens darkened to brown or black. Rather uniform in structure except humeri which vary from broadly rounded obtuse to narrowly rounded acute.

Type material.—Uhler described this species from a cotype series. One female has been selected as lectotype, labeled in Uhler's longhand with the following data: line 1, *humeralis;* line 2, June 28 Uhler; line 3, Sept. 30 on *Carya;* line 4, Md. Lectotype in U. S. National Museum.

Distribution.—This species is widely distributed in the United States, being found throughout the East and South north to Massachusetts, New Hampshire, Michigan, and Iowa, and westward through Kansas, Colorado to California.

Biology.—Taken in New Jersey from small oaks in August and September, in New York and New Jersey from pine and in Colorado from small bushes. The author took it in Michigan in copula from black oak in July. Torre-Bueno (1939) records it from hickory and hazel also. Recorded as being predaceous.

Dendrocoris contaminatus Uhler

Dendrocoris contaminatus Uhler, 1897, Trans. Md. Acad. Sci. 1:390; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:263; 1911, Ent. News 22:269; Bergroth, 1908, Mem. Soc. Ent. Belgique 15:177; 1914, Ann. Soc. Ent. Fr. 83:440; Kirkaldy, 1909, Cat. Hemip. 1:151; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Van Duzee, 1917, Cat. Hemip. N. Amer.: 65; Ruckes, 1938, Bul. Brookl. Ent. Soc. 33:13; Torre-Bueno, 1939, Ent. Americana 19:241.

Liotropis contaminatus: Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62; Osborn, 1909, Ent. News 20:177.

Easily distinguished by its general coloration, and differs from *humeralis* in its more square male genital segment and short, obliquely narrowing head.

Color.—Flavotestaceous or tinted with ochraceous or rufous with cicatrices of pronotum dark ochraceous or piceous, color extending toward humeral angles and in contrast to general body color. Punctured rather uniformly with concolorous punctures for most part, but black on anterior part of pronotum, black interrupted at middle and irregular on head. Antennae flavotestaceous to pale rufous, rostrum the same with typical dark markings. Under-surface flavotestaceous usually paler than dorsum, with rose spots on venter of abdomen laterally, not always present; punctures colored as venter. Spiracles pale or fuscous to black.

Structure.—Form broad-oval, with moderately prominent humeri. Head width to length a ratio of 1.18 to 1; sides converging obliquely to rounded tip; vertex and base of tylus convex. Juga longer than tylus and either contiguous in front or not. Almost all of tubercle of antennifer visible from above. Lateral margins of pronotum before humeri slightly concave. Length: ♂, 6.0-6.8 mm.; ♀, 6.5-7.7 mm. Width: ♂, 3.8-4.55 mm.; ♀, 3.8-4.55 mm.

Male genitalia.—Hypopygium as in figure 5, broader and more square apically, than *humeralis,* mesal angle of hypopygial plate less prominent, with a blunt lobe on lateral margin of plate near apex; ental arm of clasper prominent, more bluntly rounded than in *humeralis,* ectal arm as in *humeralis* but less rounded; proctiger and aedeagus as in *humeralis.*

Female genitalia.—As in *humeralis,* except that genital plates are hidden by sixth ventral abdominal segment, and subgenital plates are more acute at apex.

Variation.—Color varies as mentioned above, the darkened area on anterior part of pronotum varying considerably in its extent. Occasionally the spiracles are black. General form constant, lateral margins of pronotum sometimes almost straight. In many specimens the juga are non-contiguous before the tylus.

Type material.—Uhler described the species from a cotype series. One female specimen has been selected as lectotype, labeled in Uhler's longhand with the following data: *D. contaminatus* on the first line and Ariz. in the lower left hand corner. Lectotype in U. S. National Museum.

Distribution.—Found in Southwestern United States from Texas, New Mexico, Arizona, California and Utah.

Biology.—Osborn (1909) records this species as feeding on *Opuntia,* and Hubbard collected it from *Opuntia fulgens* and from *Cereus.* E. W. Davis collected it in September from *Covillea tridentata*, R. S. Beal from *Larrea* by beating in July and J. H. Russell from *Larrea* in April. Ruckes (1938) took it frequently while beating *Quercus gambeli* near Santa Fe, New Mexico.

Dendrocoris fruticicola Bergroth

Dendrocoris fruticicola Bergroth, 1891, Revue d'Ent. 10:228; 1914, Ann. Soc. Ent. Fr. 83:440; Lethierry and Severin, 1893, Cat. Gen. Hemip., Tome I: 186; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:263; 1911, Ent. News 22:269; Kirkaldy, 1909, Cat. Hemip. 1:151; Van Duzee, 1909, Buf. Soc. Nat. Sci. Bul. 9:157; 1912, Proc. Ent. Soc. Hawaii 2:126 (*fruticicola* cited in error); 1917, Cat. Hemip. N. Amer.: 64; Torre-Bueno and Engelhardt, 1910, Can. Ent. 42:148; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Blatchley, 1926, Heterop. East. N. Amer.: 174; Torre-Bueno, 1939, Ent. Americana 19:241.

Liotropis fruticicola: Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Differs from *humeralis* and *arizonensis* in black color of spiracles and in its lack of markings on connexivum.

Color.—Pale ochraceous above and below, usually with an orange or ferruginous tinge above becoming rufous on corium. Punctures of dorsum variable, rufous to castaneous and black. Head punctured with castaneous or black except for an impunctate oval area mesal to each eye and impunctate margins on juga. Antennae rufous, paler basally. Lateral margins of pronotum darker than disk with punctures of pronotum extremely variable in color, median impunctate line sometimes obliterated, punctures concentrated toward margins and forming four dark spots across middle of disk, lateral two sometimes faint or absent. Punctures of thoracic pleura concolorous or pale castaneous laterally, coarse on propleura, less coarse and less numerous on meso- and metapleura. Legs pale ochraceous basally, becoming rufous distally. Scutellar punctures variable in color, coarse and numerous at base, progressively finer toward apex, a dark spot at antero-lateral angles and one on each side at apex of frenum. Hemelytra pale ochraceous or rufous, at least rufous on disk or with rufous punctures, with impunctate areas on disk. Membrane pale ochraceous, transparent. Connexivum pale yellow tinted with orange, with extreme apical angle of abdominal segments dorsally and ventrally, posterior edge of female genital segment on either side and a large spot at each incisure of connexivum next to costal margin, black. Venter of abdomen pale ochraceous, smooth with fine punctures laterally. Spiracles black and elevated.

Structure.—General form as in *arizonensis* but more convex dorsally. Head width to length a ratio of 1.29 to 1. Humeral angles of pronotum generally less rounded than in *arizonensis*. Length: ♂, 7.0-7.9 mm.; ♀, 7.1-8.8 mm. Width: ♂, 4.5-4.9 mm.; ♀, 4.4-5.4 mm.

Male genitalia.—Hypopygium as in figure 6, lateral angles of hypopygial plate blunt and more prominent than in *humeralis;* clasper like *humeralis* but with ectal lobe acute; proctiger and aedeagus like *humeralis*.

Female genitalia.—As in *humeralis*.

Variation.—Color varies as mentioned above, occasionally without orange or ferruginous tints in general coloration. Spot on connexivum at each incisure is distinct but sometimes quite small. General form rather uniform with an occasional specimen having lateral margins of pronotum before humeri slightly concave.

Type material.—Bergroth described the species from a cotype series. One male has been selected as lectotype, with the printed label bearing the following data: Duval Co., Fla. Lectotype in U. S. National Museum.

Distribution.—Restricted to southeastern United States, recorded from Florida, North Carolina, Georgia and Alabama.

Biology.—Torre-Bueno (1939) records it from scrub oak and H .G. Barber collected it at Wilmington, North Carolina in April on oak. The author collected one specimen while beating long-leaf pine at Southern Pines, North Carolina in June.

Dendrocoris arizonensis Barber

Dendrocoris arizonensis Barber, 1911, Ent. News 22:270; Bergroth, 1914, Ann. Soc. Ent. Fr. 83:440; Van Duzee, 1917, Cat. Hemip. N. Amer.: 65; Torre-Bueno, 1939, Ent. Americana 19:241.

Closely related to *humeralis* from which it can be distinguished by its straight antero-lateral margins of pronotum and divergent mesal carinae on hypopygium; from *fruticicola* it differs as mentioned in the key to species.

Color.—Pale stramineous to pale testaceous above and below with rosy tints frequently showing on corium. Dorsum punctured with castaneous, with black punctures frequently occurring on head, anterior and lateral parts of pronotum and on lateral parts of corium. A small block spot marks base of tubercle of antennifer before eye. Antennae and legs colored as venter or rufous, sometimes ferruginous. Connexivum as dorsum or tinted rufous, closely and concolorously punctate except at base and apex of each segment where surface is smudged with fuscous encircling smooth pale calloused edges of incisures; lateral margin of connexivum either side of incisures, black. Lateral edges of abdomen either side of incisures of segments 2-5, tip of 6th and edges of female genital segment, black. Spiracles usually pale, occasionally black.

Structure.—Form broad-oval with humeral angles moderately prominent and rounded. Head width to length a ratio of 1.25 to 1, sides slightly converging anteriorly to broadly rounded front; vertex slightly raised; juga contiguous, sometimes overlapping before tylus. Lateral margins of pronotum before humeri straight. Length: ♂, 6.6-7.3 mm.; ♀, 7.4-9.25 mm. Width: ♂, 3.9-4.5 mm.; ♀, 4.3-5.5 mm.

Male genitalia.—Hypopygium as in figure 7, similar to *humeralis* but with the antero-ventral apex of mesal carinae divergent instead of convergent; ental arm of clasper less prominent than in *humeralis* and ectal lobe angular; proctiger with concave surface extending dorsally farther than in *humeralis*; aedeagus as in *humeralis.*

Female genitalia.—As in figure 15, not as coarsely punctured as in *humeralis,* subgenital plates more acuminate and more in line with body axis than in *humeralis.*

Variation.—Color varies considerably as mentioned above, some specimens being almost wholly ferruginous or rufous. General form rather constant with some variation in the pronotal humeri, occasionally barely projecting beyond side margins of body.

Type material.—Holotype and paratypes in the U. S. National Museum (the author used the term cotype for paratype; description made from two females and one male).

Type locality.—Huachuca Mts., Ariz.

Distribution.—In Southwestern United States from California, Arizona, Texas and Colorado.

Biology.—One female was collected at the base of the Pinal Mts., Ariz. in September from oak by D. K. Duncan and two males were collected at Palo Alto, California in May from oak. The author took one at Prescott, Arizona in August while beating oak. This is the only information available as to the biology of this species.

Dendrocoris suffultus (Distant), new combination

Atizies suffultus Distant, 1893, Biol. Cent. Amer., Heterop., 1:456, pl. 39, fig. 20.

A large Mexican species that resembles *arizonensis* but can be distinguished by concave antero-lateral margins of pronotum and black spiracles.

Color.—Pale ochraceous and stramineous above, pale stramineous below, above punctured with dark brown and black punctures, ventral punctures concolorous or pale ochraceous. Head stramineous, ochraceous basally, margined with black; punctures above, black, coarse and partially confluent, outlining a smooth oval area mesal to each eye. Head beneath impunctate anteriorly on juga, punctures coarse posteriorly and tinged with pale rufous. A black spot before eye extends onto base of tubercle of antennifer. Antennae moderately ferruginous, basal joint paler. Rostrum stramineous, terminal segment ochraceous with typical black markings. Pronotum stramineous, cicatrices ochraceous; punctures black and concentrated laterally and anteriorly, brown and less concentrated on disk leaving a faint median impunctate line that extends to both anterior and posterior margins. Scutellum colored as pronotum with disk punctured dark brown, punctures darker and concentrated as spots, one on either side where frenum ends and one near the apex; black punctures arranged along basal margin and forming indistinct spots at lateral basal angles. Hemelytra stramineous, faintly tinted with pale rufous on disk, deep rufous on ventral surface of corium; punctures dark brown and fairly sparse on disk leaving irregular smooth areas, but black and more concentrated basally and laterally. Membrane transparent, smoky. Connexivum pale stramineous with suffuse pale rufous markings, a broad band at base and apex of each segment surrounding smooth pale edges of incisures, black, extending to lateral margins. Dorsal disk of abdomen black. Ventral surface of thorax and abdomen spotted with pale rufous. Propleural punctures coarse and numerous medially becoming less coarse laterally; mesopleural punctures moderately coarse but sparse; those of metapleura fine, a little heavier lateral to evaporative area. Legs stramineous at base tinged with rufous toward apex of femora and on ochraceous tibiae, tarsi moderately ferruginous. Venter of abdomen colored as mentioned above, with apical and basal angles of segments and spiracles, black.

Structure.—Form broad-oval, broadest across humeral angles. Head width to length a ratio of 1.30 to 1, sides narrowing anteriorly to broadly rounded front; vertex slightly raised; tylus enclosed at tip by juga. Tubercles of antennifer clearly visible from above. Lateral margins of pronotum slightly concave before prominent rounded humeri. Length: ♂, 7.5-8.4 mm; ♀, 7.8-9.0 mm. Width: ♂, 4.70-5.15 mm; ♀, 4.75-5.25 mm.

Male genitalia.—Hypopygium as in figure 8, similar to *arizonensis* but with more prominent mesal and lateral angles on hypopygial plates; ental arm of clasper prominent, ectal arm slightly shorter and more blunt, clasper with a lobe at base of ectal arm laterally; proctiger as in *arizonensis,* aedeagus similar to *humeralis* but more rounded with apex of lateral penis lobes turning dorsally and not as prominent, median penis lobe more slender.

Female genitalia.—Similar to *humeralis,* but genital plates are hidden by sixth abdominal segment.

Variation.—Fairly uniform in color and structure. Connexivum paler and humeral angles of pronotum acute in one pair from Cuernavaca, Morelos, Mexico, in the California Academy of Sciences collection; median impunctate line on pronotum sometimes obliterated.

Type.—Described from a single male specimen; Chilpancingo, Guerrero, Mexico, H. H. Smith. British Museum. Dr. W. E. China compared specimens from Cuernavaca, Mexico with the type. The characteristic outline of the male genital segment of *Dendrocoris* as seen from above is clearly visible in Distant's figure.

Distribution.—Collected in Mexico from Cuernavaca, Morelos; and intercepted in the United States on orchids from the following localities: Tuxtla, Chiapas; and Tepechitlan, Zacateca.

Biology.—One recorded from *Epidendrum* sp. and ten recorded from ''orchid plants.''

Dendrocoris variegatus, new species

The contrasting colors make this one of the most colorful species of the genus. Distinctive features: Male with denticulate head and hypopygial plates fused with sides of hypopygium. Like *suffultus* it is taken from orchids.

Color.—Above ochraceous with brown markings, below head and thorax stramineous, abdomen pale ochraceous with rufous markings. Punctures below concolorous with body color, coarse on head and pleura, fine and sparse on abdominal venter; above variable. Head punctures coarse, numerous, concolorous with a few light brown punctures on lateral margins of juga. Antennae light ferruginous; rostrum stramineous at base and light ferruginous distally with typical dark markings. Pronotum with brown on humeri; punctures concolorous on anterior two thirds, black on anterior lateral margins, brown on posterior third and forming an indistinct spot on either side on middle of disk. Punctures sparse toward middle of disk leaving an impunctate median line on anterior half and a raised smooth anterior margin. Punctures of scutellum ochraceous, fine and sparse on disk, becoming coarser and dark brown toward base and lateral margins, a broad band of brown punctures marking lateral and distal margins of posterior half, concentrated near apex of frenum. Hemelytra ochraceous becoming brown on disk and pink laterally at base; punctures brown except laterally at base where they are concolorous with hemelytra. Punctures coarse at base becoming finer on lateral margins and toward apex, an irregular impunctate area occurring on corium two thirds of way from base on lateral margin and smaller impunctate areas on disk. Membrane transparent, faintly smokey; connexivum pink, posterior lateral angles of segments above and below, black.

Structure.—General form like *humeralis* with abdomen more narrow. Head short and broad with width to length a ratio of 1.36 to 1, sides parallel; rounded apex of juga with widely spaced denticles in male, smooth in female; vertex flatly raised. Tubercle of antennifer entirely visible from above. Lateral margins of pronotum before humeri concave, tooth at anterior lateral angle moderately prominent. Length: ♂, 6.75-7.3 mm; ♀, 7.1-8.5 mm. Width: ♂, 4.3-4.5 mm; ♀, 4.3-5.3 mm.

Male genitalia.—Hypopygium as in figure 9, anterior margin of hypopygial plate obliquely produced to antero-lateral margin of cup; a tooth is located at antero-ventral apex of each mesal carina; ental arm of clasper prominent, ectal arm produced but not as prominent; proctiger slightly convex ventrally, with a concavity dorsally; lateral penis lobes not as prominent as in *humeralis*, distally curving ventro-mesally, median penis lobe more slender.

Female genitalia.—Differs from *humeralis* in the larger broadly rounded genital plates which are narrowly separated and in the subgenital plates which are broader in comparison to length than in *humeralis*.

Variation.—Some specimens have the dark punctures extending over whole surface of pronotum and head. Three specimens show pale rufous markings on scutellum and some lack the pink markings laterally at base of hemelytra and on connexivum. In form the species is rather constant with slight variation in humeral angles. One female from Tejupilco, Mexico, Mexico, in the University of California collection has the anterior margin of juga uneven.

Type material.—Holotype: Male; Oaxaca, Oaxaca, Mexico, intercepted at Laredo, Tex. on orchids, December 20, 1949. U. S. National Museum. 4 ♂ and 11 ♀ paratypes—distributed in MEXICO—1, Chilpancingo, Guerrero, intercepted at Laredo, Texas, February 4, 1947; 1, Chilpancingo, Guerrero, intercepted at Laredo, Texas, March 27, 1946; 3, Mexico, intercepted at San Francisco, Calif., June 13, 1938; 1, Chiapas, intercepted at Laredo, Texas, April 1, 1952; 1, Sinaloa, intercepted at Nogales, Arizona, November 20, 1948; 1, Sinaloa, intercepted at Nogales, Arizona, June 9, 1938; 1, Mexico, intercepted at Laredo, Texas, February 17, 1947; 4, Michoacan, June 14, 1938; 1, San Luis Potosi, intercepted at Laredo, Texas, December

4, 1951; 1, Tejupilco, Mexico, June 26, 1933, H. E. Hinton and R. L. Usinger.

These paratypes are distributed in the following collections: 10, U.S. National Museum; 4, California Academy of Sciences; 1, University of California.

Distribution.—In Mexico as mentioned above.

Biology.—Eleven specimens were intercepted on orchids so this species is evidently similar to *suffultus* in its habits.

Dendrocoris reticulatus Barber

Dendrocoris reticulatus Barber, 1911, Ent. News 22:270; Bergroth, 1914, Ann. Soc. Ent. Fr. 83:440; Van Duzee, 1917, Cat. Hemip. N. Amer.: 65; Torre-Bueno, 1939, Ent. Americana 19:241.

This species differs from others in the genus by its broad oval body form, and ornately developed penis lobes in the male aedeagus.

Color.—Uniform pale ochraceous, sometimes colored with rufous. Upper surface coarsely and uniformly punctured with pale to fairly dark castaneous except on corium where irregular smooth areas exist on disk between exterior vein and clavus; punctures sometimes becoming black toward margins of head, less frequently so on lateral margins of pronotum, corium and connexivum. Juga with a dark brown or black line marking the lateral margin. Antennae pale rufous usually with basal segment pale yellow. Rostrum straw colored with typical markings. Entire under surface pale ochraceous but usually paler than dorsum and with punctures concolorous or pale castaneous on pleural regions, side margins of abdomen, and lateral impressed lobes of male genital segment. Legs of same color as venter, usually shaded with rufous, especially on tarsi. Disk of abdominal venter sparsely punctate and sometimes with flecks of red which are more numerous toward lateral margins. Rim of spiracles and apical angle of each abdominal segment, black.

Structure.—Form short and broad, with moderately prominent humeral angles. Head with width to length a ratio of 1.37 to 1, sides converging to rounded tip; vertex flat; tylus noticeably shorter than juga, the latter contiguous in front. Only distal part of tubercle of antennifer visible from above. Second joint of antennae in male subequal or longer than in female. Lateral margins of pronotum before humeri straight. Length: ♂, 5.7-8.0 mm; ♀, 6.3-8.2 mm. Width: ♂, 3.75-5.2 mm; ♀, 4.0-5.4 mm.

Male genitalia.—Hypopygium as in figure 10, hypopygial plate barely produced at mesal and lateral angles, thickened at mesal angle and with a setae-bearing lobe at lateral margin turning postero-ventrally; each mesal carina with a tooth just before the antero-ventral apex; ental arm of clasper short and rounded, ectal lobe acutely rounded; proctiger concave with convex margins. Aedeagus with simple median penis lobe, but with greatly produced lateral penis lobes, extending laterally and turning posteriorly as in *humeralis* but with two smaller lobes extending from curve, one anteriorly and one ventro-mesally, and two extending mesally from lobe distal to curve, one half way from curve to apex and one at apex.

Female genitalia.—As in figure 12. Genital plates (larger than any others of this genus) contiguous mesally. Subgenital plates broader than in *humeralis*.

Variation.—General coloration remarkably stable, varying slightly as mentioned above. Punctures more variable, an occasional specimen with black punctures along lateral margins of body and on head and some with bright orange punctures. Form rather constant with a slight variation in humeral angles, some are broadly rounded while others are narrowly rounded. Extremely variable in size, the smaller specimens were set aside as a possible new species in some collections.

Type material.—Holotype and paratypes in the U.S. National Museum (the terms type and cotype were used by the author).

Type locality.—Huachuca Mts., Ariz.

Distribution.—Limited to Arizona.

Biology.—Two females were collected in July at Oracle, Ariz. from white oak by E. P. Van Duzee. Nothing else is known of the biology of this species.

Dendrocoris pini Montandon

Dendrocoris pini Montandon, 1893, Proc. U. S. Nat. Mus. 16:51; Barber, 1906, Mus. Brookl. Inst. Sci. Bul. 1:263; 1911, Ent. News 22:269; Bergroth, 1908, Mem. Soc. Ent. Belgique 15:178; Kirkaldy, 1909, Cat. Hemip. 1:151; Proc. Ent. Soc. Hawaii 2:126; Banks, 1910, Cat. Nearct. Hem.-Het.: 84; Van Duzee, 1914, Trans. San Diego Soc. Nat. Hist. 2:5; 1917, Cat. Hemip. N. Amer.: 65; Bergroth, 1914, Ann. Soc. Ent. Fr. 83:440; Torre-Bueno, 1939, Ent. Americana 19:241.

Liotropis pini: Van Duzee, 1904, Trans. Amer. Ent. Soc. 30:62.

Its small size and oval body form are enough to separate this species from others in the genus.

Color.—Pale yellow ochraceous or ferruginous above and beneath. Punctures same color as body, or slightly dark in color, beneath pale concolorous. Head fully or partly margined with piceous or black. Antennae ferruginous usually paler toward the base. Rostrum concolorous as body with red tint and typical dark markings. Legs concolorous as body, in many cases ferruginous distally. Dark anterior and posterior lateral angles of abdominal segments visible from a side view. Spiracles concolorous with body.

Structure.—General form oval. Head width to length a ratio of 1.13 to 1, obliquely narrowing to rounded front; vertex and base of tylus moderately convex; juga contiguous in front. Disk of pronotum with irregular raised smooth areas, humeri not prominent, lateral margins before humeri straight or slightly convex. Scutellum with irregular raised impunctate areas on its lateral and apical margins. Hemelytra with a pale impunctate area in middle of disk and smaller irregular ones on lateral margins. Length: ♂,[3] 5.4-6.7 mm; ♀, 5.4-7.3 mm. Width: ♂, 3.3-4.0 mm; ♀, 3.3-4.2 mm.

Male genitalia.—Hypopygium as in figure 11, with mesal angle of hypopygial plate not produced and lateral angle barely produced; clasper similar to that of *humeralis* with ectal lobe more prominent; proctiger less concave ventrally than in *humeralis;* aedeagus with lateral penis lobes more prominent laterally and median penis lobe more acutely produced than in *humeralis.*

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[3] Montandon, 1893 records a minimum of 5 mm., smaller than any specimens at the writer's disposal.

Female genitalia.—Similar to but differs from *reticulatus* in the less prominent genital plates which are separated at the base by one half their width and in the less prominent middorsal plate.

Variation.—General coloration may be wholly rufous or almost so. Structurally quite constant, the humeri vary in prominence from distinctly broader than body to the same width.

Type material.—Montandon described the species from a cotype series. One male has been selected as lectotype, with a printed label containing the following data: line 1, Argus Mts.; line 2, May 91 K. Lectotype in the U.S. National Museum.

Distribution.—Found in western and southwestern United States from the following states: Oregon, Utah, California, Arizona, New Mexico and Colorado.

Biology.—Cotype series collected from *Pinus monophylla* in May; recorded also from pine from other localities.

Dendrocoris neomexicanus, new species

Female similar to *pini*, but the concave antero-lateral margins of pronotum quickly separate it from that species; male similar to *contaminatus*, but smaller and differs in color as noted in key.

Color.—Ground color ochraceous above and below, above heavily colored with rufous, with a waxy appearance; below with rufous tints on head and pleura. Head above mainly rufous, ochraceous showing at anterior end, on margins of juga, on base of tylus and on vertex mesal to each ocellus, black marking base of head behind each ocellus and extending to eye. Punctures coarse, concolorous with body color, more sparse at lateral margins of juga, at base of tylus and on lateral parts of vertex. Head beneath pale ochraceous, with pale rufous marking undersurface of juga, with black behind each eye and a small spot of black from before each eye to base of tubercle of antennifer; punctures concolorous as general color. Antennae dark ochraceous, basal joint pale. Rostrum ochraceous with typical markings. Pronotum profusely colored with rufous, ochraceous showing on median anterior and posterior margins and irregularly on disk; punctures ochraceous or rufous except on cicatrices and a few before and behind inner margin of cicatrices, which are black; punctures sparse on disk showing irregular smooth areas, becoming more numerous at margins. Pleural regions pale ochraceous with a small dark brown spot just before anterior median angle of evaporative area and a black line marking posterior margin of evaporative area. Pleural punctures coarse, concolorous ochraceous, except for a few dark brown punctures at anterior and posterior margins of propleura. Legs ochraceous with tarsi a little darker and distal portion of femora with definite rufous markings. Scutellum rufous with ochraceous showing on middle lateral margins and on apex, with dark spots, one on either side where frenum ends, one at each basal lateral angle and one on each side of basal margin midway between the lateral margin and median line; punctures colored same as scutellum, fairly coarse, finer apically, sparse on raised portion of disk, an impunctate and raised area occurring within lateral basal angles. Hemelytra ochraceous along median margin, gradually becoming rufous toward lateral margins; punctures moderately coarse and numerous on lateral and mesal margins, disk showing a large impunctate area, punctures concolorous laterally and on some parts of disk, but dark brown or black along mesal margin, dark punctures forming a faint spot midway along the lateral margin of the corium and another more definite spot toward the apex of the corium laterally. Membrane transparent, colorless. Connexivum ochraceous with dark brown apical angles laterally and an incomplete dark brown band at base and apex of each segment, band at base distinct but apical band becomes indistinct on posterior four segments. Abdominal venter ochraceous with a dark spot at lateral apical angles of segments; punctures concolorous ochraceous, extremely fine, with the disk almost impunctate.

Structure.—General form broad-oval. Head width to length a ratio of 1.20 to 1, feebly narrowing to rounded front; vertex and base of tylus distinctly convex, tylus depressed anteriorly; juga contiguous in front and broadly rounded on the margins. All of tubercle of antennifer seen from above. Pronotum short and broad, humeri not prominent, lateral margins distinctly concave before the humeri with the antero-lateral tooth small and indistinct. Length: ♂, 5.8 mm; ♀ 6.25-6.6 mm. Width: ♂, 3.3 mm; ♀, 3.7-3.85 mm.

Male genitalia.—Hypopygium as in figure 13, with mesal angle of hypopygial plate not produced, and a small blunt notch in posterior margin near lateral angle; internal genitalia not examined in the one specimen available.

Female genitalia.—Similar to *pini* but differs in position of genital plates which are hidden by sixth abdominal segment in this species.

Variation.—Male differs from female as follows: clay yellow above and below, ochraceous on head above and scutellum, rufous limited to punctures of abdominal venter. Dark markings more definite with the following additions: Punctures of pronotum toward center of anterior margin, behind cicatrices and across basal third, black; cicatrices black. Pleural regions with black punctures more numerous on propleura and near evaporative area. Tarsi darker. Punctures of scutellum pale brown to black. Punctures of hemelytra black except at base of lateral margin where they are ochraceous. Connexivum with black band at base and apex of each segment. Structurally like female. Dark markings more distinct on one female and vary to indistinct or absent on the others. Slight rugae may appear near base of scutellum on either side.

Type material.—Holotype: ♀; Mountain Park, New Mexico, June 27, 1940, R. H. Beamer. Snow Collection, University of Kansas. Five paratypes—2 as above; 1, Fort Wingate, New Mexico, June 8, 1935, E. C. Van Dyke; 2 (one of which is the only male specimen), Gallup, New Mexico, August 18, 1954.

These paratypes are distributed in the following collections: 2 (the male and one female), U.S. National Museum; 1, Snow Collection, University of Kansas; 1, California Academy of Science; 1, University of Michigan.

Distribution.—As mentioned above, New Mexico.

Biology.—The pair, collected by the author at Gallup, New Mexico, were taken while beating *Juniperus* sp.

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BOOK REVIEW

THE WORLD OF THE HONEYBEE, by Colin G. Butler. Cloth, xiv + 226 pp., 2 colored and 40 black and white plates, 1954. A volume in ''The New Naturalist'' series, MacMillan, $4.50.

This book by the head of the Bee Department at the Rothamsted Experimental Station in England is an engaging and authoritative presentation of honeybee behavior and the organization of its social life. It is not a manual of beekeeping! As is usual with volumes in ''The New Naturalist'' series, this one is written in a very readable style which will appeal to the layman. Still, it is sufficiently technical so that the general entomologist and animal behaviorist can obtain a wealth of information from it. The photographs by the author are superb and have been well chosen to illustrate many phases of behavior. There are extended discussions of the latest published researches on bee behavior such as the monumental studies by von Frisch on honeybee language and senses, and those of Lindauer on the division of labor in the colony. The author also discusses his theory of ''queen substance,'' a product which the worker bees probably obtain by licking any part of the queen's body surface. This substance is passed from one household bee to another during the movement and feeding that is continually going on among bees engaged in duties within the hive. Butler suggests that this ''queen substance'' enables the bees in a colony to determine the loss or physical weakening of the queen even though only a small number have been in actual contact with her. So long as the queen is in good health and produces enough of this material, the ''queen substance'' is thought to inhibit the construction of all kinds of queen cells and the production of laying workers, and to promote colony cohesiveness.—KARL V. KROMBEIN, *Agricultural Research Service, Washington, D. C.*

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